Dr. Ajith Thomas

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PROFESSIONAL SUMMARY

I am an experimental physicist and educator with a PhD in Physics, specializing in polymer and quantum dot-based solar cells, photodetectors, and hybrid energy devices. With over a decade of teaching and research experience, I combine deep technical knowledge with hands-on innovation, developing custom scientific instruments, microcontroller-based systems, and interactive physics demonstrations.

I am passionate about making science accessible through experimental teaching methods, innovative instrumentation, and outreach activities such as building large-scale replicas (e.g., Chandrayaan-3 re-enactment model). My work bridges advanced research with education, aiming to inspire the next generation of scientists.

EDUCATION

Doctor of Philosophy (PhD) in Physics | 2022
Bharathiar University, Coimbatore, Tamil Nadu, India.
Thesis: *Polymer based solar cells - Exploring schemes for performance enhancement*

Master of Science (MSc) in Physics | 2010
Mahatma Gandhi University, Kottayam, Kerala, India.

Bachelor of Science (BSc) in Physics | 2008
Mahatma Gandhi University, Kottayam, Kerala, India.

RESEARCH INTERESTS

- Polymer Solar Cells
- Hybrid Solar Cells
- Quantum Dot Solar Cells
- UV and visible photodetectors
- Colloidal semiconductor nanocrystals

PROFESSIONAL EXPERIENCE

Lecturer in Physics
Nirmala College, Muvattupuzha / St. Dominic's College, Kanjirappally / St. Thomas College, Palai - Kerala, India | 2018 – 2024

- Taught advanced physics courses at undergraduate and postgraduate levels, incorporating custom experimental demonstrations to enhance learning.

- Supervised 4 PG and 22 UG students in research projects on optoelectronics, thin films, and material characterization.
- Developed hands-on teaching aids and lab-based activities to simplify complex concepts.
- Mentored students in device fabrication and experimental methods.
- Conducted outreach programs with physics demonstrations for school students.
- Provided training in experimental physics teaching for higher secondary science teachers in Kerala.

Project: Chandrayaan-3 Working Model

Nirmala College, Muvattupuzha, Kerala, India | 2024

- Designed and fabricated a 1:1 scale working model of India's Chandrayaan-3 lunar mission to educate students and the public on lunar landing operations.
- Received appreciation from the Vikram Sarabhai Space Research Centre, India, for educational impact.

RESEARCH EXPERTISE

- **Nanocrystal Synthesis & Characterization:** Experienced in colloidal synthesis and analysis of PbS, PbSe, CdSe, CdTe, and CdS quantum dots.
- **Solar Cell Fabrication:** Skilled in quantum dot, polymer–fullerene, and hybrid (polymer–inorganic) solar cell fabrication.
- **Photodetectors:** Developed high-sensitivity UV/visible photodetectors using ZnO and quantum dots.
- **Laboratory Setup:** Established facilities for nanocrystal synthesis and thin-film device fabrication (Schlenk lines, spin coating, substrate prep).
- **Custom Instrumentation:**
  - ➢ RF Plasma Cleaner (custom RF generator + vacuum chamber)
  - ➢ Magnetron Sputtering System (HV supply, vacuum, water-cooled magnetron)
  - ➢ Fast-Response Thermocouple Probe (0.7 s response)
  - ➢ Controlled Atmosphere Coating Setup (inertness, temperature, humidity control)
- **Embedded Systems & Electronics:** Proficient in Raspberry Pi, ESP32, Arduino, circuit design, automation, and mechanical fabrication.

TECHNICAL SKILLS

- **Material Synthesis:** Quantum dots, core-shells, Schlenk line methods, inert atmosphere control.
- **Fabrication:** Spin/dip coating, vacuum evaporation, DC magnetron sputtering, RF plasma cleaning.
- **Characterization:** EQE, IQE, AFM, TEM, SEM, XRD, XPS/UPS, FTIR, Raman, UV-Vis.
- **Instrumentation Design:** Solar simulators, spin coaters, plasma systems, thermocouples, atmosphere-controlled setups.

- **Programming & Electronics:** Microcontroller programming, circuit design, sensor integration.
- **Mechanical:** Soldering, welding, cutting, grinding, and painting.

PUBLICATIONS

1. Ajith Thomas, Anju Elsa Tom, V.V. Ison. (2022). *An inverted architecture P3HT:CdSe bulk-heterojunction hybrid solar cell utilizing a quantum junction with high open circuit voltage and efficiency.* Energy Reports, 8, 12979. DOI: 10.1016/j.egyr.2022.09.190.
2. Ajith Thomas, R. Vinayakan, V. V. Ison. (2020). *An inverted ZnO/P3HT:PbS bulk-heterojunction hybrid solar cell with a CdSe quantum dot interface buffer layer.* RSC Advances, 10, 16693. DOI: 10.1039/D0RA02740E.
3. Ajith Thomas, Anju Elsa Tom, Arun D. Rao, Arul Varman K., R. Vinayakan, Praveen C. Ramamurthy and V. V. Ison (2014), *Solvent polarity and nanoscale morphology in bulk hetero-junction organic solar cells: a case study*, Journal of Applied Physics, 115,104302. doi:10.1063/1.4867642.
4. Anju Elsa Tom, Ajith Thomas, Ajeesh Kumar Somakumar, Libin Kuriakose and V. V. Ison (2023), *Performance enhancement of PbS quantum dot solar cells employing a hybrid solid-state ligand exchange protocol*, Thin Solid Films 787, 140138, doi:10.1016/j.tsf.2023.140138.
5. Anju Elsa Tom, Ajith Thomas and V. V. Ison (2020), *Novel post-synthesis purification strategies and the ligand exchange processes in simplifying the fabrication of PbS quantum dot solar cells*, RSC Advances 10(51), 30707, doi:10.1039/D0RA05242F.
6. Jobin Job Mathen, Ajith Thomas, Augustine J. Edakkara, Jose Sebastian, J. Madhavan and Ginson P. Joseph, (2017), *Fabrication of Al deposited sandwich capacitor structure with CdSe / PVA dielectric thin film by spin coating technique for high power applications: synthesis and characterizations, Journal of Materials Science: Materials in Electronics*. 28, 7544, doi:10.1007/s10854-017-6444-2.
7. N. J. Simi, S. Bharathi Bernadsha, Ajith Thomas and V.V. Ison, (2021), *Quantum Dot Sensitized Solar Cells using Type-II CdSe-Cu2Se Core-Shell QDs*, Results in Optics, 4, 100088, doi:10.1016/j.rio.2021.100088.
8. Jobin Job Mathen, J. Madhavan, Ajith Thomas, Augustine J. Edakkara, Jose Sebastian and Ginson P. Joseph, (2017), *Transparent ZnO- PVA binary composite for UV-A photodetector: optical, electrical and thermal properties followed by laser induced fluorescence*, Journal of Materials Science: Materials in electronics 28, 7190, doi:10.1007/s10854-017-6400-1.
9. Deepu Thomas, K.A. Vijayalakshmi, Kishor Kumar Sadasivuni, Ajith Thomas, Deepalekshmi Ponnamma, and John-John Cabibihan, (2017), *A fast responsive ultraviolet sensor from mSILAR-processed Sn-ZnO*, Journal of Electronic Materials 46, 6480, doi:/10.1007/s11664-017-5680-9.

PAPERS PRESENTED INTERNATIONAL/NATIONAL CONFERENCES/SEMINARS

1. *A high open-circuit voltage environment-friendly hybrid solar cell utilizing P3HT:ZnO active layer*, International Conference on Advances in Physico-chemical and biological science for environmental and biodiversity conservation, March 21-22, 2023, Newman College, Thodupuzha, India.
2. *Role of P3HT as a hole transporting layer in ligand engineered PbS hybrid solar cells*, National Seminar on Recent Advances in Materials Science (RAMS), September 7-8, 2018, NSS Hindu College, Changanacherry, Kerala.
3. *Synthesis of monodisperse PbS quantum dots using organo-metallic procedures employing a specially designed temperature probe*, International Conference on Material Science and Technology (ICMST 2016), June 5-8, 2016, St. Thomas College, Palai, India.
4. *Structural studies on PbSe quantum dots synthesized using colloidal routes,* National Seminar on Nanochemistry and Nanobiotechnology (NANOCHEMBIO 2014), October 8-9, 2014, St. Thomas College, Palai, India.
5. *Photovoltaic studies of PbSe quantum dot based solar cells,* International Conference on Electrical, Electronics, and Optimization Techniques (ICEEOT 2016), March 3-5, 2016, DMI College of Engineering, Chennai, Tamilnadu.
6. *Heterojunction TiO2/PbS quantum dot solar cells,* International Conference on Electrical, Electronics, and Optimization Techniques (ICEEOT 2016), March 3-5, 2016, DMI College of Engineering, Chennai, Tamilnadu.
7. *Synthesis and characterization of Lead Selenide quantum dots for photovoltaic application,* International Conference on Electrical, Electronics, and Optimization Techniques (ICEEOT 2016), March 3-5, 2016, DMI College of Engineering, Chennai, Tamilnadu.
8. *Effect of Nitrobenzene additive in P3HT:PCBM bulk-heterojunction solar cells*, National Seminar on Emerging Nanomaterials (NSEN 2015), January 6-7, 2015, Deva Matha College, Kuravilangad, India.
9. *Role of solvent polarity in controlling the active layer morphology of P3HT:PCBM solar cells*, National symposium on research directions in solar energy, April 1-2, 2014, IISc Bangalore, India.
10. *Microstructure optimization of active layer in P3HT:PCBM based polymer solar cells*, National Seminar on Recent trends in Conducting polymers and Polymer nanostructures, August 29-30, 2013, Aquinas College, Edacochin, India.

ADDITIONAL INFORMATION

- **Teaching Philosophy**: Committed to fostering curiosity and critical thinking through hands-on experimental learning and interdisciplinary approaches.
- **Professional Development**: Actively participated in workshops and training programs on advanced material synthesis and renewable energy technologies.